

CLAIMS

1. A method of treating an organic matter, comprising the steps of:

5 drying an organic matter as a raw material;
 gasifying the dried raw material to produce a generated gas; and

 recovering sensible heat from the generated gas and/or a combustion gas produced by said gasifying step;

10 wherein air, nitrogen gas, carbon dioxide gas, or a mixture of at least two of air, nitrogen gas and carbon dioxide gas is used as a heating medium used in said recovering step, and the heating medium heated in said recovering step is introduced into said drying step for use
15 as a heating medium gas for drying.

2. A method according to claim 1, wherein in said drying step, a raw material drying apparatus for bringing the heating medium gas into direct contact with
20 the raw material is used, and the heating medium gas whose humidity has been increased by evaporated water is cooled by treated sewage discharged from a sewage treatment facility to condense water content in the heating medium gas and lower the humidity of the heating medium gas, and
25 the heating medium gas whose humidity has been lowered is reused as the heating medium gas for drying.

3. A method according to claim 1 or 2, wherein when the heating medium gas for drying is cooled by the
30 treated sewage, the heating medium gas and the treated sewage are brought into direct contact with each other to cool the heating medium gas and wash away a solid material contained in the heating medium gas with the treated sewage.

4. A method according to any one of claims 1 to 3, wherein the generated gas produced by said gasifying step is introduced into a gas engine or a gas turbine to recover power therefrom.

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5. A method according to claim 4, wherein thermal energy is recovered from an exhaust gas discharged from said gas engine or said gas turbine using the heating medium gas comprising air, nitrogen gas, carbon dioxide gas, or a mixture of at least two of air, nitrogen gas and carbon dioxide gas, and the heating medium gas which has been heated is introduced into said drying step for use as the heating medium gas for drying.

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6. A method according to claim 4 or 5, wherein a fuel comprising natural gas, town gas, propane gas, gasoline, kerosine, gas oil, or a heavy oil is supplied as an auxiliary fuel or a main fuel to said gas engine or said gas turbine.

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7. A method according to any one of claims 4 to 6, wherein the amount of fuel supplied to said gas engine or said gas turbine is adjusted so that the sum of the amount of thermal energy recovered from the generated gas and/or the combustion gas that is produced in said gasifying step and the amount of thermal energy recovered from an exhaust gas discharged from said gas engine or said gas turbine is equal to or higher than the amount of thermal energy that is required in said drying step.

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8. A method of treating an organic matter, comprising the steps of:

supplying an organic matter to a gasification chamber;

5 gasifying the organic matter to produce a combustible gas and residue in said gasification chamber;

combusting the residue produced in said gasification chamber in a combustion chamber to produce a combustion gas; and

10 introducing the combustible gas produced in said gasification chamber into a gas engine or a gas turbine to recover power;

wherein said gasification chamber and said combustion chamber are provided in an internally circulating fluidized-bed gasification furnace, and a bed material is circulated between said gasification chamber and said combustion chamber.

9. A method according to claim 8, wherein a heat exchange between the combustible gas produced in said gasification chamber, the combustion gas produced in said combustion chamber and an exhaust gas from said gas engine or said gas turbine, and air is carried out to recover sensible heat from these gases, and the air heated by the heat recovery is used as drying air for drying the organic matter.

10. A method according to claim 9, wherein the drying air used for drying the organic matter is heated by a heat exchange between the drying air, and the combustible gas, the combustion gas and the exhaust gas, and is circulated again for use as the drying air, and part of the drying air which is circulated is introduced into said internally circulating fluidized-bed gasification furnace and is deodorized therein.

11. A method according to claim 10, wherein a water content in the drying air used for drying the organic matter is condensed away to lower the rate of the water content in the drying air.

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12. A method according to claim 11, wherein the water content in the drying air is condensed away by a direct heat exchange between the drying air and cooling water.

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13. A method according to claim 11 or 12, wherein a sewage drain is used as cooling water to condense away the water content in the drying air.

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14. A method according to any one of claim 8 to 13, wherein a scrubber is provided for cleaning the combustible gas supplied from said gasification chamber, and a temperature-lowering and dust-removing apparatus is provided upstream of said scrubber, whereby the combustible gas is treated by said temperature-lowering and dust-removing apparatus to lower a temperature of the combustible gas to a value ranging from 150°C to 250°C for condensing tar in the combustible gas and to remove dust from the combustible gas, and then the combustible gas is charged into said scrubber.

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15. A method according to any one of claims 8 to 14, wherein a fuel comprising natural gas, town gas, propane gas, gasoline, kerosine, gas oil, or a heavy oil is supplied as an auxiliary fuel or a main fuel to said gas engine or said gas turbine.

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16. A method according to any one of claims 8 to 15, wherein the amount of fuel supplied to said gas engine or said gas turbine is adjusted so that the sum of the amount of thermal energy recovered from the combustible gas and/or the combustion gas that is produced from said internally circulating fluidized-bed gasification furnace and the amount of thermal energy recovered from an exhaust gas discharged from said gas engine or said gas turbine is equal to or higher than the amount of thermal energy that is required to dry the organic matter.

17. An apparatus for treating an organic matter, comprising:

a gasification chamber configured to gasify an organic matter to produce a combustible gas and residue;

a combustion chamber configured to combust the residue produced in said gasification chamber to produce a combustion gas; and

a supply device configured to supply the combustible gas produced in said gasification chamber into a gas engine or a gas turbine to recover power;

wherein said gasification chamber and said combustion chamber are provided in an internally circulating fluidized-bed gasification furnace, and a bed material is circulated between said gasification chamber and said combustion chamber.

18. An apparatus according to claim 17, further comprising:

a drying apparatus for drying the organic matter; and

an air preheater for performing a heat exchange between the combustible gas produced in said gasification chamber, the combustion gas generated in said combustion chamber and an exhaust gas from said gas engine or said gas turbine, and air to recover sensible heat from the gases;

wherein the air heated by heat recovery in said air preheater is introduced as drying air into said drying apparatus.

10 19. An apparatus according to claim 18, further comprising a drying air circulation passage for leading the drying air discharged from said drying apparatus and heated by said air preheater to said drying apparatus again;

15 wherein part of the drying air which circulates through said drying air circulation passage is introduced as a gas for combustion into said combustion chamber and is deodorized therein.

20 20. An apparatus according to claim 19, further comprising a condenser for condensing away a water content in the drying air to lower the rate of the water content in the drying air;

wherein the drying air discharged from said drying apparatus is introduced into said condenser.

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21. An apparatus according to any one of claims 17 to 20, wherein a fuel comprising natural gas, town gas, propane gas, gasoline, kerosine, gas oil, or A heavy oil is supplied as an auxiliary fuel or a main fuel to said gas engine or said gas turbine.

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22. An apparatus according to any one of claims 17 to 21, wherein the amount of fuel supplied to said gas engine or said gas turbine is adjusted so that the sum of the amount of thermal energy recovered from the combustible gas and/or the combustion gas that is produced from said internally circulating fluidized-bed gasification furnace and the amount of thermal energy recovered from an exhaust gas discharged from said gas engine or said gas turbine is equal to or higher than the amount of thermal energy that is required to dry the organic matter.